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Comparison of Decision-Making and Visual Search Behavior of Expert and Novice Players

Mazaher Rahimpour[a*], Seyed Mohmmad Kazaem Vaez Mousavi[b], Mehrnoosh Bahmani[c], Amir Shams[d], Saleh Rafiee[d], Tayebe Zargar[e]

[a] Assistant Professor, Islamic Azad University, Firoozkooh Branch, Tehran, Iran.
[b] Professor at University of Imam Hossein, Tehran, Iran.
[c] Lecturer at Farhangian University of Amir Kabir Alborz, Iran.
[d] Assistance Professor of Motor Behavior, Sport Sciences Research Institute of Iran (SSRI), Tehran, Iran.
[e] Assistance Professor of Sport Management, Islamic Azad University South Tehran Branch, Tehran, Iran.

Keywords

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Mazaher Rahimpour
Email: rahimpour@iaufb.ac.ir

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Abstract

Background: The mechanisms involved in expert performance have been the focus of many researchers. One of these mechanisms is visual skills. Many researchers have tried to compare these skills among expert and novice athletes to provide different solutions to enhance their expert performance. The purpose of this study was to compare the decision-making and visual search behavior of expert and novice football players.
Methods: Participants included 14 novice male football players with an average age of 22.5 years and 14 expert male football players with an average age of 27.4 years. Both groups observed 5 attacks vs. 5 attack mice. They then announced their decision, which included four pass choices by the ball-striker. At the same time, visual search behavior was assessed with the visual detector. Independent T-test was used to evaluate decision-making, saccade movements, number and time of fixations. Equality of variances was used by Levon's test.
Results: Results showed that there was a significant difference in decision making between the two groups of expert and novice players ($P < 0.05$). There was no significant difference in saccade movements, number and time of fixation between the two groups of expert and novice players ($P < 0.05$).
Conclusion: Expert football players may be able to extract more relevant decision-making information from the same visual field as compared to the novice player that will help to make more accurate decisions.

Introduction

For the past decade, researchers have focused extensively on the cognitive aspects of performance. The superiority of expert over novice players has been demonstrated on the basis of extensive research and tests designed on cognitive skills. Hence, it seems that cognitive skills are a necessary factor for effective and efficient prediction and decision making. One of the most important aspects of perceptual skills is the difference in control of people's glare. In fact, most research has shown that the fundamental difference between a expert and a beginner in the selection of information is visual (Abernethy et al., 1987). In many team sports, including football, players must obtain accurate information about the opponent, teammate and ball in difficult and complex situations so that they can make quick and accurate decisions at the same time. These decisions must be made under the pressure of the opponent, who limit time and space. In fact, when and where players look is one of the most important aspects of

skillful performance. (Davids., 2005) Eye movements are controlled by a search strategy that leads the performer to make more efficient use of the time available for motion analysis. The ability of the performer to remove the signs in the environment or identify important patterns in the game is done using these methods (Abdoli et al., 2015)

Visual search behavior involves alternating between fixations and saccades. Fixations are periods of time when visual images are held still in the eye socket for information, and saccades are rapid eye movements that shift visual attention between positions in less than 100,000ths of a second. (Morgan., 2009) Researchers focus more on gaze stabilization, which may occur several times during visual search, the characteristics of these fixations such as number, position and duration, to find out how and what the performer Information pays attention, is used. The location of each gaze record indicates the athlete's areas of interest, while the number and duration of fixation is an indicator of the amount of information processed by the athlete. Research in this field has a different methodology; So that some researchers used the observational method, some the visual approach in practice and finally some researchers used static and dynamic slides that had different results.

As researchers in football (Mann et al., 2009; vayenz at el., 2007) table tennis (Rodrigues et al., 2002) volleyball (Pairs et al., 2014) fencing (Babadi et al., 2021) young football players (Vítor de Assis et al., 2020) in active and inactive women (Krzepota et al., 2015) showed that expert people with high number of fixations and short fixation period made more accurate decisions. Williams et al. (1994) examined the visual search strategies of novice and expert football players in terms of 3 vs. 3 and 1 vs. 1. The results of their research showed that expert players have more consolidations in a shorter time than novice players. (Davids., 2005) Other research has been shown in boxing (Ripoll et al., 1995), volleyball (Pairs et al., 2014; lee et al., 2010) and tennis (Williams, et al., 1977) that expert players have fewer but longer fixations than beginner players.

On the other hand, some research in elite and beginner basketball referees (Goulet et al., 1989) and in expert and beginner basketball players (Abdoli et al., 2015) showed that there is no difference between the number and duration of their vision stabilization.

So despite research on eye movements and expertise control in sports, there are still controversies over whether performers' vision search is different because of expertise. And whether the performer's search behavior is an important and influential factor in skillful performance.

On the other hand, researchers in this field have shown that vision search strategies depend on expertise, specific to the context and needs of the task. Therefore, different tasks may benefit from different vision search strategies. Since football is an open skill and the tactical position 5 vs. 5 and 1 vs. 1 attacks occur many times in a football match and have different complexity, choosing the correct and accurate pass and identifying the best path to move in position 1 vs. 1 can change the result of the

match. Therefore, identifying the underlying factors affecting it, can be beneficial for coaches and players. Accordingly, this study sought to answer the question of whether there is a difference between expert and novice football players in number, duration of vision stabilization, and decision making.

Method

Subjects

The method of the present study is causal-comparative. The participants in this study were football players. Fourteen players from the 16 teams of the Iranian Premier League participated in this study voluntarily and were placed in the expert group. The other 14 volunteer players who played for fun and did not participate in any official competitions were also included in the beginner group. The average age of expert players was 27.14 and the average age of beginner players was 22.5. The playing history of expert players was 8.64 years and the playing history of beginner players was 2.15 years.

Apparatus and task

The tools used in this research are as follows:

Video Camera

Initially, two camcorders were used to make a clip from position 5 vs. 5. These cameras included the GoPro 5 sports camera and the Sony HD camera. After filming this situation, 40 6 to 10 second clips (Williams., 1994) were produced by video conversion software (Davids., 2005).

Vision Tracker

To evaluate the participants' vision search, the vision tracker device available in the Physical Education Research Institute of the Ministry of Science was used. This device is made in Berlin, Germany and records and measures stunning behaviors with a shooting speed of 60 Hz and an accuracy of 0.5. The hardware part of this device includes lightweight glasses worn by the participant and has two eye movement cameras as well as a stage camera to record the events of the environment. The other part of the device hardware includes the Samsung phone, which records and collects data through the I wiew 2.7 software installed on it. The obtained data are analyzed through B Gaze 3.6 software. Each software is made by SMI in Berlin, Germany.

Video Projector

Sony VPL-EX100 video projector was used to play the clips.

Researcher-made questionnaire for scoring clips

The researcher-made questionnaire of players' decision-making skills was made by the researcher. This questionnaire was designed to answer the clips. Formal and content validity of the decision questionnaire was taken by a number of experts (4 coaches of the Iranian Football Premier League and 4 experts). For each clip, a four-choice question was designed and scored. Score 4 in response to option 1, score 3 in response to option 2, score 2 in response to option 3 and score 1 in response to option 4.

Procedure

To collect data, players participating in the test were first asked to complete a form that included personal information such as age, level of play, playing history, leagues they have played so far, along with a consent form to participate in the research voluntarily. Then, preliminary examinations were performed on the two groups of participants in order to exclude them from participating in the research in case of possible problems in the anatomical system of the eye or the existence of static sharpness problems in them. Participants were then subjected to two Snellen vision tests (with a 5-minute break between them). Before the test, participants were asked not to do any strenuous activity the day before the test and to sleep at 10 o'clock at night and if possible, not to use any medication.

For 5 vs. 5 positions, video clips of expert players were prepared. These clips were given to the instructors of the Asian Football Confederation and some of the coaches of the Iranian Football Premier League to confirm the accuracy of the scenes of the clips. From these clips for each situation, 5 clips were randomly selected. Naturally, before the test, the vision tracker was calibrated for each participant using a three-point method. After calibration, participants were placed at a distance of 90 cm from the screen to be shown clips in random order. The play time interval between clips was 10 seconds (Rafiee et al., 2015). For the 5 vs. 5 positions, participants were asked to announce their decision (pass to options 1 to 4) to the tester after seeing each scene. In the clips, except for the player who owns the ball, his other teammates, who had different positions, were identified from 1 to 4. The examiner recorded the subject's response for comparison with the main judgment (the opinion of the instructors and observers), and at the same time the participants' visual search was recorded by a vision tracker. The participant must state the best pass option from his / her point of view by mentioning the number of the player who would prefer to be given the pass so that the examiner can record it. This pass selection was recorded as the participant's decision.

Figure 1. Conditions 5 vs. 5 attacking beginner and expert players.

Data Analysis

Data were collected and categorized using descriptive statistics. Independent T was used to test the hypotheses and Leven test was used to equalize the variances.

Results

The demographic characteristics of the participants are listed in Table 1.

Table 1. Review of participants' indicators.

Groups	Number Mean ±Sd	Age (years) Mean ±Sd	Play History (years)
Expert players	14	27.14± 7.03	8.64±2.37
Novice players	14	22.05 ± 80.5	2.15±0.6

According to the results of Table 1, it is concluded that in decision-making, there is a significant difference between the two groups of expert and novice players in position 5 versus 5 attacks (P = 0.002). The results showed that there was no significant difference in the number of consolidations between the two groups of expert and novice players (P = 0.215). Also, during the consolidations, there is no significant difference between the two groups of expert and novice players (P = 0.134). In saccade movements, there is no significant difference between the two groups of expert and novice players (P = 0.931).

Table 2. Results of independent t-test for decision making, number and duration of vision stabilization of expert and novice players.

Independent T-Test		Mean	Sd	Df	T-Value	P-Value
Decision making skills	Expert	35.07	4.35	25	3.527	0.002*
	Novice	20.01	3.49			
Number of visual fixations	Expert	29.47	3.83	25	1.273	0.215
	Novice	27.72	3.24			
Duration of visual stabilization	Expert	7224.4	858.55	25	1.551	0.134
	Novice	670.82	870.20			
Sakadi movements	Expert	26.18	7.92	25	0.087	0.931
	Novice	25.96	4.04			

According to the results of Table 2, it is concluded that the number and time of consolidation of expert players is more than the novice.

Table 3. Mean and standard deviation of number and time (milliseconds) of all stabilizations in position five versus five for designated and undeveloped points.

Variable	Skill Level	Mean	Sd
Number of all fixations	Expert	27.72	3.24
	Novice	29.47	3.84
Time of all fixations (milliseconds)	Expert	7224.4	858.55
	Novice	670.82	870.20

According to the results of Table 3, it is concluded that the novice players had a greater number of fixations for the designated and unspecified points. But the expert players were better during the registrations.

Discussion and Conclusion

The aim of this study was to compare the decision making and vision search behavior of novice and expert football players in 5 vs. 5 attacks. The results of the decision showed that there is a significant difference between the decision of expert and novice players. Better performance of expert people is due to their greater ability in the structure of recognition and the frequency of their presence in such visual spaces, which leads to a more efficient use of search time. Expert players also have more efficient processing of background information and storage of this information in long-term memory, which helps them make decisions (Rafiee et al., 2015). From a theoretical point of view, the special ability to encrypt and retrieve sports information effectively and accurately is of great value in decision making. Helsen and Powell (1992, 1993) examined the pattern of search used during tactical decision-making (position 3 vs. 3 and 4 vs. 4) in football. The results of their research showed that expert players made more accurate and appropriate decisions than beginners. Wines et al. (2007) examined differences in the decision-making and vision search strategies of football players in different attack situations (2 vs. 1, 3 vs. 1, 3 vs. 2, 4 vs. 3, and 5 vs. 3). The results of their research showed that when the number of players increased, the decision time increased and the accuracy of the decision decreased, which is in line with the present study (by examining the averages). On the other hand, Ghasemi (2013) in beginner, expert and non-athlete referees, Hancock et al. (2013) in ice hockey referees, Rafiei et al. (2015) in basketball referees, and Vitor (2020) in young football players achieved similar results.

The results of the present study did not show any significant differences in the visual search behavior (number and duration of stabilization) of expert and beginner players. According to previous research, visual search behavior can be an important factor in distinguishing expert and novice people; Because research has shown that expert and novice people differ in the number and duration of vision stabilization. In some cases, the number of low and long-term fixations (Ripoll et al., 1995; lee et al., 2010) and in some studies, the number of high-duration fixations (Rodrigues et al., 2002; Mann et al. ., 2009) has been a characteristic of expert people that is not consistent with the findings of the present study; However, these results were obtained by Kato's research with the help of national and international football referees, Hancock (2013) in Haki referees, Rafiei (2015) in expert and beginner basketball referees, Abdoli et al. (2016) in beginner and expert basketball players who obtained similar results was consistent. On the other hand, Moinirad et al. (2018) disagreed with the research on the number of fixations but was consistent at the time of fixations. In Moinirad's research, basketball shots were examined, but the present study was position 5 against 5 attacks in football, which differed in terms of complexity and type of task. On the other hand, he was opposed to Babadi's research (2021) on the number and time of fixations. Due to the lack of differences in visual search behavior; But the superiority of expert players in decision-making can be said that expert players may have the ability

to extract information related to the right decision from the same field of vision compared to novice players, which helps them make more accurate decisions. Several factors can be involved in obtaining such results, some of which are mentioned below. In other disciplines, similar results were obtained. For example, Williams et al. (1994) stated that expert players have a greater ability to acquire important information quickly than novice players; But they do not have a different vision search pattern than novice players; They hypothesized that the reason for these differences might be how to use this information and not how to collect it; That is, the difference may be in the distinction between looking and seeing (information processing). So that two people, with a consolidation pattern, have absorbed different information. This means that a point of view may be recorded on an area; But absorbing information from another region should be done using peripheral vision. Football players may have the same number and duration of vision stabilization when watching; But seeing different areas may lead to different decisions. In 5 vs. 5 attacks, which is a complex task with a different structural timing, expert players, in addition to seeing the opponent's defender (central vision), see their own space and the opponent (peripheral vision). Therefore, the number and time of their consolidations may be less than the beginner players seen in the present study. Williams and Davids (1997) stated that expert soccer players use their environmental vision to assess the condition of teammates and opponents.

In the basic assumptions about vision search skill, an efficient and selective search pattern consists of less fixations within a longer period, and these lower query values are due to an increase in the role of peripheral vision in the retrieval of information related to the task. In terms of time constraints, expert players use peripheral vision to extract information from the position and movements of other players as they keep their eyes on a specific area. Descriptive research data showed that expert players have fewer stabilizations over a longer period of time. The results of this section with the research of Piras (2010) in volleyball, Kerzputa et al. (2016) in football in 1 vs. 1 defensive conditions, Padillas et al. (2017) in football and in 2 vs. 1 defensive condition and Helsen et al. (1999) in football was consistent.

Expert players seem to be better at making decisions than novice players. This advantage of expert players is due to the increased cognition developed by them through performance in sports. The knowledge structure developed helps coaches and trainers to improve specific sport decisions. On the other hand, there was no difference between the number and duration of their visual stabilization. The type of research methodology (visual search approach) is probably influential in this regard. Different methods of examination will have different needs. Measuring visual search behavior in real conditions with unrealistic laboratory conditions will lead to different results. It is suggested that in addition to conducting research in real-world conditions (outside the laboratory environment), other attack situations be performed

with a larger number of individuals with high complexity. Considering how the test was performed and the test environment was stated for the subjects; However, it seems that one of the limitations of the present study was the mental condition of the subjects before and during the test.

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Conflict of interest

The authors declare that there is no conflict of interest.

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